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EXAMINER	
TORRES, JOSEPH D	
ART UNIT	**PAPER NUMBER**
2133	8

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

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Office Action Summary	Application No.	Applicant(s)
	09/838,610	MILLER ET AL.
	Examiner	Art Unit
	Joseph D. Torres	2133

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 March 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-14 and 16-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-14 and 16-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 April 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. In view of Amendment A of Paper No. 7, the Examiner withdraws the objection to the specification.

Claim Objections

2. Claims 3 and 4 are objected to because of the following typographical errors: “the Berlekamp-Massey module” in lines 1-2 of claim 3 should be replaced with --the Berlekamp-Massey computation module-- (Note: it is clear from the context of the claim language that --the Berlekamp-Massey computation module-- was intended since a Berlekamp-Massey module is inherently a Berlekamp-Massey computation module). Appropriate correction is required.

Claim 4 depends from claims 3; hence inherits the deficiencies in claim 3.

Claim Rejections - 35 USC § 112

3. In view of Amendment A of Paper No. 7, the Examiner withdraws previous 35 U.S.C. 112 rejections to claims 3, 4, 9 and 16.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1, 3-13 and 20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "the internal quadratic-subfield Galois-field representation" in lines 15-16. There is insufficient antecedent basis for this limitation in the claim. Lines 6-7 in claim 1 recite, “an internal Galois field representation comprising a quadratic-subfield representation” and lines 15-16 recite, “the internal quadratic-subfield Galois-field representation”. The Examiner asserts that “Galois field representation comprising a quadratic-subfield representation” is not necessarily a “quadratic-subfield Galois-field representation” and hence it is not clear where the “quadratic-subfield Galois-field representation” came from. The Examiner assumes the Applicant intended the following in place of "the internal quadratic-subfield Galois-field representation" in lines 15-16: --the internal Galois field representation comprising a quadratic-subfield representation--.

Claim 4 recites the limitation "the quadratic-subfield modular multipliers" in lines 1-2. There is insufficient antecedent basis for this limitation in the claim.

Claim 20 recites similar language as in claim 1, hence is rejected for the same reasons.

Claims 3-13 depend from respective claim 1; hence inherit the deficiencies in claim 1.

Claims 1, 3-13 and 20 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See

MPEP § 2172.01. Lines 6-7 in claim 1 recite, "an internal Galois field representation comprising a quadratic-subfield representation" and lines 15-16 recite, "the internal quadratic-subfield Galois-field representation". The omitted structural cooperative relationships are: the relationship between "an internal Galois field representation comprising a quadratic-subfield representation" and "the internal quadratic-subfield Galois-field representation". The Examiner assumes the Applicant intended the following in place of "the internal quadratic-subfield Galois-field representation" in lines 15-16: --the internal Galois field representation comprising a quadratic-subfield representation--.

Claim 20 recites similar language as in claim 1, hence is rejected for the same reasons.

Claims 3-13 depend from respective claim 1; hence inherit the deficiencies in claim 1.

Response to Arguments

5. Applicant's arguments with regard to amended claims 1, 3, 4, 9, 14 and 16 and previously examined claims 5-8, 10, 11-13 and 17-19 filed 29 March 2004 have been fully considered but they are not persuasive.

The Applicant contends, "neither the Okita or Cameron patents, taken singly or together, or taken in combination with any of the other cited patents, do not disclose or suggest the use of internal quadratic-subfield Galois-field representations of codes". The Examiner asserts that the Applicant claims, "an internal Galois field representation

comprising a quadratic-subfield representation" in lines 6-7 in claim 1 and not an "internal quadratic-subfield Galois-field representations".

The Examiner disagrees and asserts that the circuit of Figure 1 in Okita is a translator circuit for receiving one of a predetermined number of Reed-Solomon codes that each have predetermined external Galois-field $GF_b(2^m)$ representations and for translating the external Galois-field representation of the received code into an internal Galois field $GF_a(2^m)$ representation. The Examiner asserts that a Galois field comprising quadratic-subfield of a Galois-field is still a Galois-field, that is, the term Galois-field encompasses and includes any Galois field comprising quadratic-subfields of a Galois-field since a Galois field comprising quadratic-subfield of a Galois-field is a Galois-field, hence by restricting the internal Galois-fields in the Okita patent to internal Galois fields comprising a quadratic-subfield of Galois-field only restricts it to Galois-fields already included and encompassed by the translator circuit of Figure 1 in Okita.

In addition, the Examiner would like to point out Galois fields generally arise out of polynomial field extensions over one or more finite subfields and any Galois field is inherently a Galois subfield of a larger Galois field arising out of a polynomial extension. Furthermore; any Galois Field is inherently comprised of subfield extensions over irreducible polynomials over a smaller subfield hence, more explicitly; external Galois-field $GF_b(2^m)$ representations and internal Galois field $GF_a(2^m)$ representation in Okita are inherently comprised of subfield extensions over irreducible polynomials. The examiner asserts that a quadratic equation is a polynomial; hence as stated before the

Okita patent encompasses and includes Galois Fields comprised of subfield extensions over quadratic polynomials, i.e., quadratic-subfields of a Galois-field.

The Applicant contends, "the Okita or Cameron patents, taken singly or together, do not disclose or suggest 'translating one of a predetermined number of Reed-Solomon and BCH codes that each have predetermined external Galois-field representations into an internal quadratic subfield Galois-field representation' or 'translating the internal quadratic subfield Galois-field representation of the error-corrected code into the external Galois-field representation'". The Examiner disagrees and asserts that Galois fields generally arise out of polynomial field extensions over one or more finite subfields and any Galois field is inherently a Galois subfield of a larger Galois field arising out of a polynomial extension, hence, more explicitly; external Galois-field $GF_b(2^m)$ representations and internal Galois field $GF_a(2^m)$ representation in Okita are inherently can be extended to a larger field using irreducible quadratic equations over external Galois-field $GF_b(2^m)$ representations and internal Galois field $GF_a(2^m)$ representation whereby external Galois-field $GF_b(2^m)$ representations and internal Galois field $GF_a(2^m)$ representation would be quadratic subfields of the Galois-field extensions of the external Galois-field $GF_b(2^m)$ representations and internal Galois field $GF_a(2^m)$ representation. Furthermore; any Galois subfield is still a Galois field with all the same structural properties of a Galois field and hence the teachings in the Okita patent encompass the use of any Galois subfield since a Galois subfield is a Galois field and the teachings in the Okita patent are directed to any Galois field. The Examiner asserts

that restricting the use of the circuitry taught in the Okita patent to a subset of the Galois fields for which it was designed does not require an inventive step just like restricting a juicer for making fruit juices to a juicer for making pear juice does not require an inventive step nor does it structurally change the juicer in any manner.

The Applicant contends, "the Okita or Cameron patents, taken singly or together, do not disclose or suggest the use of a Berlekamp-Massey module that 'carries out repeated dot product calculations between vectors'". The Examiner disagrees and asserts that Berlekamp-Massey module as taught in Okita is inherently a module for performing Galois-Field computations over matrices and vectors defined over the Galois fields. A dot product is a Galois-Field computation over two vectors and a repeated dot product calculation is a Galois-Field computation multiplying a matrix times a vector treating the rows of the matrix as vectors and repeatedly taking the dot product of the rows and the vector. The Examiner asserts that syndromes required in the Berlekamp-Massey algorithm are calculated by multiplying the parity matrix by the received vector during decoding.

The Applicant contends, "Okita or Cameron patents, taken singly or together, do not disclose or suggest the use of 'quadratic-subfield modular multipliers'". The Examiner disagrees and asserts that as pointed out above a subfield is still a field so that multipliers for a subfield are still multipliers for a field. The Berlekamp-Massey circuit in the Okita patent requires Galois Field multipliers for computations required by the

Berlekamp-Massey algorithm and the design in the Okita patent encompasses, includes and was designed for any field including quadratic subfields.

The Applicant contends, "the Okita or Cameron patents, taken singly or together, do not disclose or suggest that 'tile Berlekamp-Massey computation module and the Chien-Forney module each include a quadratic-subfield-power integrated divider that carries out Galois-field division in a quadratic-subfield representation'". As pointed out in the previous office action Okita explicitly teaches the use of Galois-field inversion in col. 2, lines 15-18 and the design in the Okita patent encompasses, includes and was designed for any field including quadratic subfields.

The Applicant contends, "the use of a switch referred to by the Examiner is not a disclosure or suggestion regarding 'Providing for switching among different codes and among codes of different degrees of shortening.' This is not discussed in either the Okita or Cameron patents". The Examiner disagrees and asserts that as the Examiner pointed out in the previous Office Action, 118 in Figure 1 of Okita is switch for switching between Reed-Solomon codes, RSa, RSb,...,RSx.

The Applicant contends, "Claim 7 recites that "clocks controlling the syndrome computation module, the Berlekamp-Massey computation module, and the Chien-Forney module are separate and freerunning clocks requiring no fixed phase relationship, to allow maximum speed and flexibility for the clocks of each module." It is

respectfully submitted that there is no disclosure contained in the Okita, Cameron or Vaccaro et al. patents, taken singly or together, that suggests this. The mere fact that the Vaccaro et al. patent states that it is a "programmable systolic BCH decoder" (see title) is not a disclosure or suggestion of the aspects of the present invention specifically recited in Claim 7". The Examiner asserts that systolic designed circuitry is defined as circuitry divided into modules whereby the modules are separate with freerunning clocks requiring no fixed phase relationship which the Applicant agrees with on page 4, lines 3-12 of the Applicants specification. Okita and Cameron teach separate syndrome computation, Berlekamp-Massey computation, and Chien-Forney modules (see Figure 1 in Cameron) as pointed out in the last office action. Vaccaro teaches the use of a systolic decoder implementing the syndrome computation, Berlekamp-Massey computation, and Chien-Forney modules (col. 1, lines 49-53, Vaccaro) explicitly for the purposes of improving speed and size advantage (col. 5, lines 4-7, Vaccaro). The Examiner asserts that one of ordinary skill in the art at the time the invention was made would have been highly motivated to make the syndrome computation, Berlekamp-Massey computation, and Chien-Forney modules taught in the Okita and Cameron patents systolic as taught in the Vaccaro patent since as Vaccaro teaches, such an implementation would have improved speed and provided a size advantage (col. 5, lines 4-7, Vaccaro).

The Applicant contends, "Claim 9 was rejected under 35 U.S.C. § 103(x) as being unpatentable over US Patent No. 6,378,104 issued to Okita and US Patent No.

6,317,858 issued to Cameron in view of US Patent No. 5,754,563 issued to White ... It is respectfully submitted that the Okita and Cameron devices would not be modified in light of the teachings of the White patent without using hindsight reconstruction. There is disclosure or suggestion contained in the Okita or Cameron patents regarding the desire to process data in parallel, and therefore adding this feature was not contemplated by them. Modifying the teachings of the Okita or Cameron patents to provide for parallel operation therefore extends their express teachings beyond the scope of the patents, using hindsight reconstruction, using the teachings of the cited patents in light of Applicants' own teachings". The Examiner disagrees and asserts that the suggestion itself for parallel processing (see Title of White) comes from the White patent, which clearly precedes the Applicant's teachings.

The Applicant contends, "It is respectfully submitted that a review of the Vaccaro et al. patent reveals that it does not disclose or suggest 'exclusive-OR trees" used in the "syndrome module and the Chien-Forney module.'... The terms "exclusive-OR trees" and "Chien-Forney" are not even used in the Vaccaro et al. patent." The Examiner disagrees and asserts that the Galois field operations required in the Okita, Cameron and Vaccaro patents are performed using exclusive-OR trees since the Galois Field elements are vectors over the binary field G(2) and must be converted to binary data (Note: digital devices operate on binary data not Galois Field elements). The structure of the exclusive-OR trees depends on the Galois Field only. As pointed out in the previous Office Action, Cameron teaches using Forney's algorithm to calculate error

values (Forney algorithm circuit 15 in Cameron). The Examiner asserts that both a syndrome generator and a Chien-Forney calculator require Galois Field operations that depend on the particular Galois field representation requiring exclusive-or trees for implementation in digital circuitry, that is; exclusive-or trees are equivalent representations for Galois field arithmetic, which is taught the Okita, Cameron and Vaccaro patents. The Examiner would also like to point out that a single X-or gate is and x-or tree of 1.

The Examiner disagrees with the applicant and maintains all rejections of the dependent and independent claims. All amendments and arguments by the applicant have been considered. It is the Examiner's conclusion that claims 1, 3, 4, 9, 14 and 16 and previously examined claims 5-8, 10, 11-13 and 17-19 are not patentably distinct or non-obvious over the prior art of record in view of the references, Okita; Shigeru (US 6378104 B1), Cameron; Kelly (US 6317858 B1), Vaccaro; John J. et al. (US 5323402 A) and White; Philip E. (US 5754563 A) as applied in the last office action, Paper No. 6. Therefore, the rejection is maintained.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1, 3-6, 8, 10, 11, 13, 14, 16, 17, 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okita; Shigeru (US 6378104 B1) in view of Cameron; Kelly (US 6317858 B1).

See Paper No. 6 for detailed action of prior rejections of claims 1, 3-6, 8, 10, 11, 13, 14, 16, 17 and 19.

35 U.S.C. 103(a) rejection of claim 20.

Okita teaches a Reed-Solomon BCH error correction decoder for decoding a predetermined number of Reed-Solomon and BCH codes (col. 5, 26-37 and Figure 1 in Okita is a Reed-Solomon error correction decoder for decoding a predetermined number of Reed-Solomon codes; Note: Reed Solomon codes are a subclass of generalized BCH codes, hence Reed Solomon codes are generalized BCH codes), said decoder comprising: a translator circuit for receiving one of the predetermined number of Reed-Solomon and BCH codes that each have predetermined external Galois-field representations and for translating the external Galois-field representation of the received code into an internal Galois-field representation (Figure 1 and the Abstract in

Okita teach that Input-Side Transformation Circuits 116 receives one of the predetermined number of Reed-Solomon and BCH codes that each have predetermined external Galois-field representations in $GF_b(2^m)$ and translates the external Galois-field representation of the received code into an internal Galois-field representation $GF_a(2^m)$; Note; Figure 2 of Okita teach that if α is the root of the m^{th} order field generation polynomial of $GF_a(2^m)$, then $\beta=\alpha^p$ is the root of the m^{th} order field generation polynomial of $GF_b(2^m)$, hence the Input-Side Transformation Circuits 116 is a translator for translating data from one Galois Field to another); a syndrome computation module for calculating syndromes comprising intermediate values required to find error locations and values (col. 6, lines 65-67 in Okita teach that Figure 4 is a syndrome generator circuit and col. 2, lines 45-47 in Okita teach that the syndrome generator circuit is used to generate syndromes for use in the Berlekamp-Massey algorithm to find error positions and values), a Berlekamp-Massey computation module comprising quadratic-subfield multipliers that implements a Berlekamp-Massey algorithm that converts the syndromes to intermediate results comprising lambda and omega polynomials (the Berlekamp-Massey algorithm is inherently an algorithm for converting syndromes to intermediate results comprising error locator, lambda, and error magnitude, omega, polynomials; The Berlekamp-Massey circuit in the Okita patent requires Galois Field multipliers for computations required by the the Berlekamp-Massey algorithm and the design in the Okita patent encompasses, includes and was designed for any field including quadratic subfields); a Chien module comprising modified Chien-search algorithm to calculate actual error locations and error

values that correspond to an error-corrected code (Col. 20, lines 46-57, Okita); and an inverse translator circuit for translating the internal Galois-field representation of the error-corrected code into the external Galois-field representation (Output-Side Transformation circuit 120 in Figure 1 of Okita is an inverse translator circuit for translating the internal Galois-field representation of the error-corrected code into the external Galois-field representation).

However Okita does not explicitly teach the specific use of a Chien-Forney module using Forney algorithms to calculate error values.

Cameron, in an analogous art, teaches using Forney algorithms to calculate error values (Forney algorithm circuit 15 in Cameron). One of ordinary skill in the art at the time the invention was made would have been highly motivated to combine the teachings of the Okita patent with the teachings in the Cameron patent since the error correction system in the Okita patent requires a means for determining error values and Forney's algorithm is a well-known means, that one of ordinary skill would have been apprised of, for determining error values. Note: Cameron explicitly teaches how a modified Berlekamp-Massey algorithm can replace the traditional Berlekamp-Massey algorithm to calculate the error position Lambda polynomial (col. 4 in Cameron).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Forney with the teachings of Cameron by including use of a Chien-Forney module using Forney algorithms to calculate error values. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that

use of a Chien-Forney module using Forney algorithms to calculate error values would have provided the opportunity to implement the Error correction system in the Okita patent by including a required means for determining error values.

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okita; Shigeru (US 6378104 B1) and Cameron; Clifton J. (US 5905740 A) in view of Vaccaro; John J. et al. (US 5323402 A, hereafter referred to as Vaccaro).

See Paper No. 6 for detailed action of prior rejections.

8. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okita; Shigeru (US 6378104 B1) and Cameron; Clifton J. (US 5905740 A) in view of White; Philip E. (US 5754563 A).

See Paper No. 6 for detailed action of prior rejections.

9. Claims 12 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okita; Shigeru (US 6378104 B1) and Cameron; Clifton J. (US 5905740 A) in view of Vaccaro; John J. et al. (US 5323402 A, hereafter referred to as Vaccaro).

See Paper No. 6 for detailed action of prior rejections.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph D. Torres whose telephone number is (703) 308-7066. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decady can be reached on (703) 305-9595. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Joseph D. Torres, PhD
Art Unit 2133